

Citation:

Purslow LR, Sandhu MS, Forouhi N, Young EH, Luben RN, Welch AA, Khaw KT, Bingham SA, Wareham NJ. Energy intake at breakfast and weight change: Prospective study of 6,764 middle-aged men and women. *Am J Epidemiol*. 2008 Jan 15; 167 (2): 188-192. Epub 2007 Dec 12.

PubMed ID: [18079134](#)

Study Design:

Prospective Cohort Study

Class:

B - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To investigate the association between percentage of daily energy intake consumed at breakfast and weight change in middle-aged men and women.

Inclusion Criteria:

Ages 40-75 years.

Exclusion Criteria:

- No follow-up examination
- No measure of weight change at follow-up
- Report of stroke, cancer or heart attack at baseline
- Did not complete a food diary at baseline.

Description of Study Protocol:**Recruitment**

Recruitment occurred between 1993-1997.

Design

Prospective cohort study.

Dietary Intake/Dietary Assessment Methodology

Seven-day food diary.

Blinding Used

Not applicable.

Intervention

Not applicable.

Statistical Analysis

- All primary analyses were conducted using percentage of total energy intake consumed at breakfast as a continuous variable. For ease of data interpretation, data is presented by quintile of total energy intake at breakfast
- Linear regression was used to assess the relation between total energy intake at breakfast, baseline BMI, and weight change over the course of follow-up
- The following confounders were tested:
 - Age
 - Sex
 - Baseline BMI
 - Smoking
 - Physical activity
 - Fruit and vegetable intake
 - Plasma vitamin C level
 - Follow-up time
 - Social class
 - Daily fat
 - Carbohydrate and protein intake
 - Alcohol consumption
 - Meal frequency
 - Energy consumed between meals.

Data Collection Summary:

Timing of Measurements

- Baseline measurements were taken from 1993-1997
- Follow-up measurements were taken from 1998-2000.

Dependent Variables

BMI was determined using height and weight measurements taken at baseline.

Independent Variables

Total energy intake from breakfast was measured using a seven-day food diary recorded at baseline.

Control Variables

- Age
- Sex
- Baseline BMI
- Smoking
- Physical activity

- Fruit and vegetable intake
- Plasma vitamin C level
- Follow-up time
- Social class
- Daily fat
- Carbohydrate and protein intake
- Alcohol consumption
- Meal frequency
- Energy consumed between meals.

Description of Actual Data Sample:

- *Initial N:*
 - N=25,631 subjects who completed baseline measures
 - N=15,028 subjects who completed follow-up measurements
- *Attrition (final N):* 6,764
- *Age:* 40-75 years at baseline
- *Ethnicity:* Not applicable
- *Other relevant demographics:* Not applicable
- *Anthropometrics:* Not applicable
- *Location:* United Kingdom.

Summary of Results:

- Compared with the lowest quintile of percentage-total energy intake at breakfast, mean BMI was lowest in persons in the highest quintile of percentage-total energy intake at breakfast (P=0.018)
- Weight change was inversely associated with percentage-total energy intake consumed at breakfast. Persons who consumed a greater proportion of their daily calories at breakfast gained relatively less weight over time.

| | Quintile 1 (0-11%) | Quintile 2 (12-14%) | Quintile 3 (15-17%) | Quintile 4 (18-21%) | Quintile 5 (22-50%) | P-value |
|-----------------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|---------|
| BMI (kg/m²) | 26.3 (0.10) | 26.3 (0.10) | 26.2 (0.10) | 26.3 (0.10) | 26.0 (0.10) | 0.018 |

| Model | Weight Gain Over Follow-up | 95% Confidence Interval | P for Trend |
|---------------------------|-------------------------------|----------------------------|-------------|
| Unadjusted | -0.032 | -0.046, -0.018 | <0.001 |
| Adjusted | -0.021 | -0.035, -0.007 | 0.003 |
| Fully adjusted | -0.021 | -0.035, -0.007 | 0.004 |

Author Conclusion:

Redistribution of daily energy intake, so that more energy is consumed at breakfast and less energy is consumed later in the day, may help reduce weight gain in middle-aged adults.

Reviewer Comments:

None.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

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|----|---|-----|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | N/A |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | N/A |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | N/A |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | N/A |

Validity Questions

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|------|---|-----|
| 1. | Was the research question clearly stated? | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified? | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated? | Yes |
| 1.3. | Were the target population and setting specified? | Yes |
| 2. | Was the selection of study subjects/patients free from bias? | Yes |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups? | Yes |
| 2.3. | Were health, demographics, and other characteristics of subjects described? | No |

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| 2.4. | Were the subjects/patients a representative sample of the relevant population? | Yes |
| 3. | Were study groups comparable? | Yes |
| 3.1. | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) | N/A |
| 3.2. | Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? | N/A |
| 3.3. | Were concurrent controls used? (Concurrent preferred over historical controls.) | N/A |
| 3.4. | If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? | Yes |
| 3.5. | If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.) | N/A |
| 3.6. | If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")? | N/A |
| 4. | Was method of handling withdrawals described? | Yes |
| 4.1. | Were follow-up methods described and the same for all groups? | Yes |
| 4.2. | Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.) | Yes |
| 4.3. | Were all enrolled subjects/patients (in the original sample) accounted for? | Yes |
| 4.4. | Were reasons for withdrawals similar across groups? | N/A |
| 4.5. | If diagnostic test, was decision to perform reference test not dependent on results of test under study? | N/A |
| 5. | Was blinding used to prevent introduction of bias? | Yes |
| 5.1. | In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? | N/A |
| 5.2. | Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) | N/A |
| 5.3. | In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? | Yes |

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| 5.4. | In case control study, was case definition explicit and case ascertainment not influenced by exposure status? | N/A |
| 5.5. | In diagnostic study, were test results blinded to patient history and other test results? | N/A |
| 6. | Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described? | Yes |
| 6.1. | In RCT or other intervention trial, were protocols described for all regimens studied? | N/A |
| 6.2. | In observational study, were interventions, study settings, and clinicians/provider described? | Yes |
| 6.3. | Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? | Yes |
| 6.4. | Was the amount of exposure and, if relevant, subject/patient compliance measured? | Yes |
| 6.5. | Were co-interventions (e.g., ancillary treatments, other therapies) described? | No |
| 6.6. | Were extra or unplanned treatments described? | No |
| 6.7. | Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups? | No |
| 6.8. | In diagnostic study, were details of test administration and replication sufficient? | N/A |
| 7. | Were outcomes clearly defined and the measurements valid and reliable? | Yes |
| 7.1. | Were primary and secondary endpoints described and relevant to the question? | Yes |
| 7.2. | Were nutrition measures appropriate to question and outcomes of concern? | Yes |
| 7.3. | Was the period of follow-up long enough for important outcome(s) to occur? | Yes |
| 7.4. | Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? | Yes |
| 7.5. | Was the measurement of effect at an appropriate level of precision? | Yes |
| 7.6. | Were other factors accounted for (measured) that could affect outcomes? | Yes |
| 7.7. | Were the measurements conducted consistently across groups? | Yes |
| 8. | Was the statistical analysis appropriate for the study design and type of outcome indicators? | Yes |
| 8.1. | Were statistical analyses adequately described and the results reported appropriately? | Yes |

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| 8.2. | Were correct statistical tests used and assumptions of test not violated? | Yes |
| 8.3. | Were statistics reported with levels of significance and/or confidence intervals? | Yes |
| 8.4. | Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? | No |
| 8.5. | Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? | Yes |
| 8.6. | Was clinical significance as well as statistical significance reported? | Yes |
| 8.7. | If negative findings, was a power calculation reported to address type 2 error? | No |
| 9. | Are conclusions supported by results with biases and limitations taken into consideration? | Yes |
| 9.1. | Is there a discussion of findings? | Yes |
| 9.2. | Are biases and study limitations identified and discussed? | Yes |
| 10. | Is bias due to study's funding or sponsorship unlikely? | Yes |
| 10.1. | Were sources of funding and investigators' affiliations described? | Yes |
| 10.2. | Was the study free from apparent conflict of interest? | Yes |